ESP Remote Sensing
“Solutions”

Clean Fuels Advisory Committee

19-SEP-2006

Gary Full

Outline

- Introduction
- Basic Value Proposition – Remote Sensing
- Set the Scene:
  - Providing “Present Solutions” for LD mobile fleet
  - Positioned to provide “Near Term Solutions” for Goods Movement Fleet
- Simple problem statement and solution statement:
  - Light Duty fleet
  - HD Truck/Bus fleet
  - Locomotive fleet
  - Marine fleet
- Q&A

Company Profile

- Principle business lines:
  - Centralized testing program design, implementation and operation
  - Emissions testing equipment sales and service
  - **Provider of remote sensing solutions for mobile source emissions testing**
  - International vehicle emissions and safety testing markets
  - Data management services to government agencies and departments
- 2,900 worldwide staff

Typical Remote Sensing Deployment

Measurement Complement

CO, CO2, HC, NO, “PM”

Speed, acceleration

Vehicle ID (picture)

Remote Sensing Technology

Value Proposition
Remote Sensing

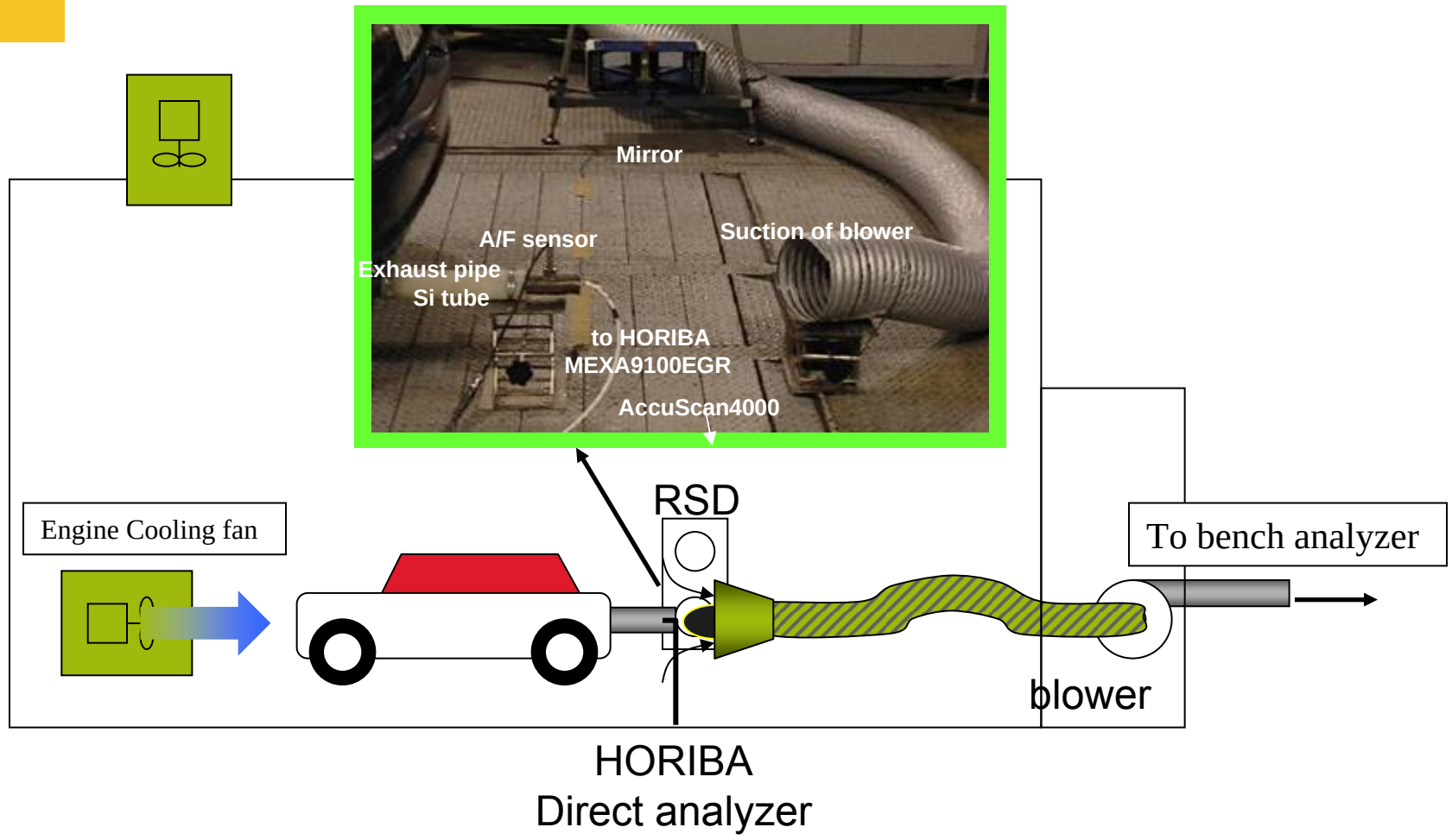
- Provides REAL-WORLD, in use measurements.
- Is non-obtrusive / non-contacting
- Can provide many measurements in a short time.
- Is accurate and has been correlated time and time and time again against traditional instrumentation methods.

RSD Correlations

- Analyzer Correlations
- Programmatic Correlations

Matches Lab Analyzers

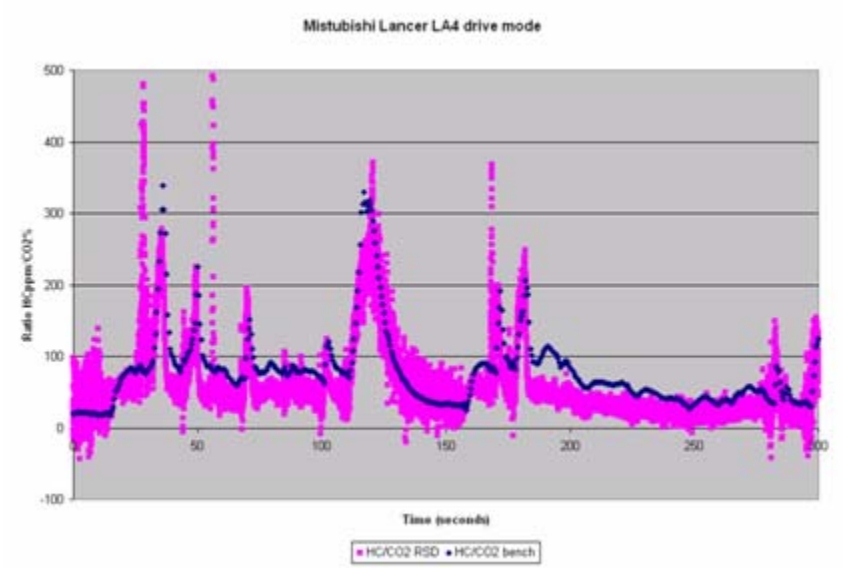
Japan Petroleum Energy Center – February 2003

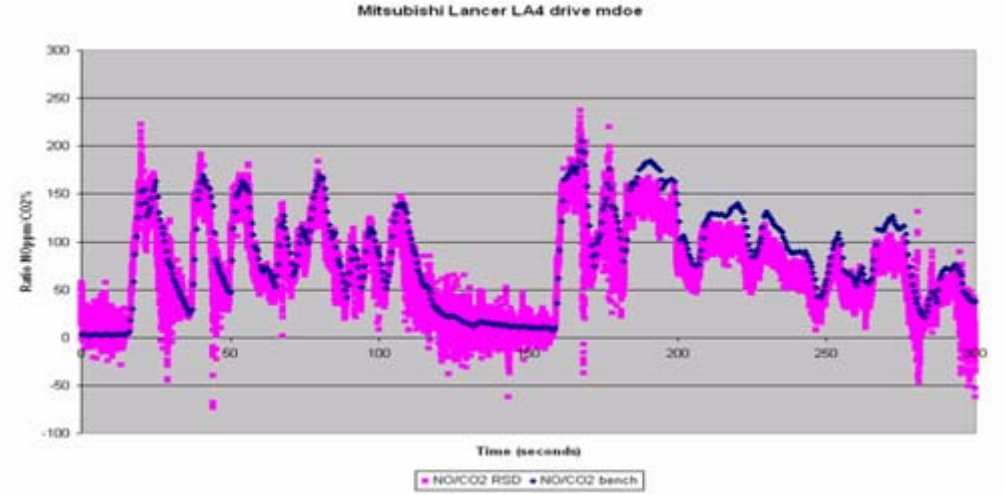


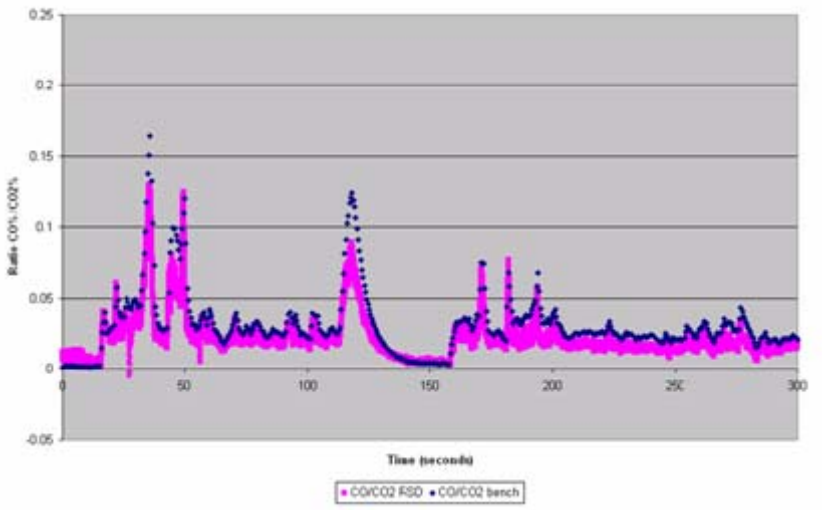
Correlation Test Results

Mitsubishi Lancer

- Several different drive modes were utilized:
  - LA4 drive mode
  - Steady state drive modes (60,40,20kph)
- Horiba analyzers were compared to RSD:
  - Compared gas ratios and their means.
    - CO/CO2, HC/CO2, NO/CO2







Matches I/M Results

California BAR High Emitter Pullover Study

- Pullover Enforcement with Roadside ASM – Final Report

2001 -06

- Upstream Dual RSD Screen

- Downstream Roadside ASM

- Aggressive Cut points
  - 2% CO, 1000pmHC, 1500ppmNO
- Results:
  - 83% - 88% ASM Failure (1 RSD Observations)
  - 92% ASM Failure (2 RSD Observations)

High Emitter – Results

False Failure Rates

California RSD pull-over study results reported:

1989 Lynwood:

86% of vehicles with RSD >2% CO failed roadside inspection

SCAQMD 1996:

95% of vehicles with RSD >4% CO or 1,000 ppm HC failed IM240

BAR 2001:

83-88% of vehicles with RSD >2% CO or 1000ppm HC or 1,500 ppm NOx failed ASM

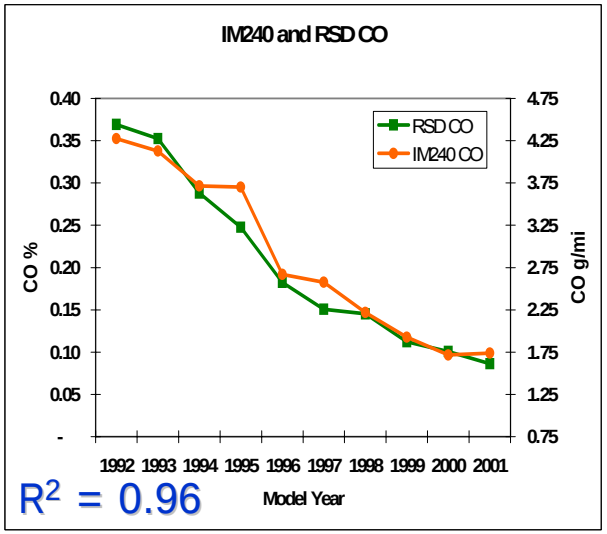
BAR/ARB 2004

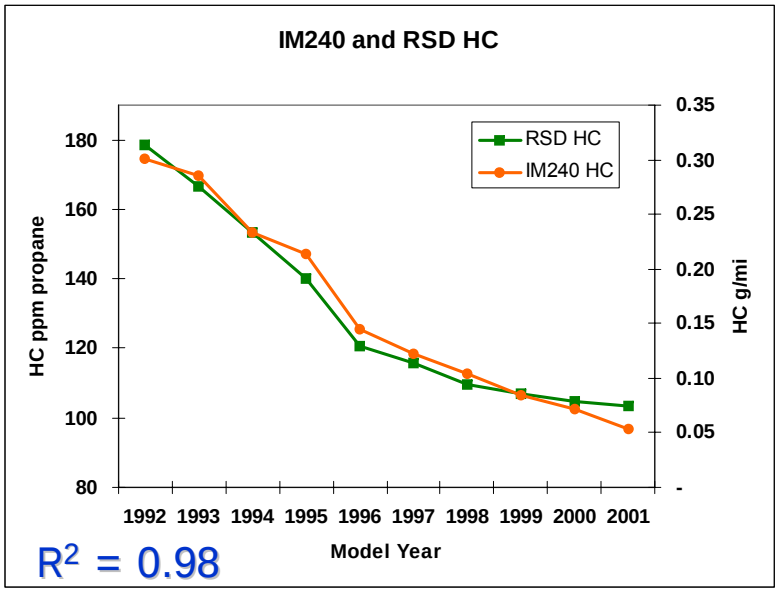
?? Preliminary consultant statements indicate that nearly 100% of RSD identified high emitters failed ASM.

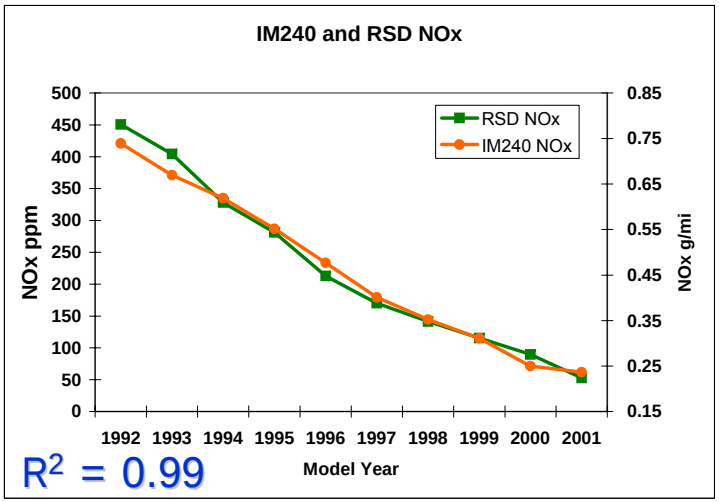
Matches Fleet Emissions

Vancouver, BC Fleet Characterization

- Only 150,000 RSD measurements
- 1992 -2001 IM240 measurements
- Model Year Average Correlation







LD Gasoline Fleet

Light Duty Fleet

- Basic Issues:
  - Traditional methods are no longer economical to eliminate the “very few” vehicles that contribute “the most” to the pollution problem.
    - Imagine a tomorrow where 99 out of 100 vehicles are zero emitters, but 1 of 100 is a “super emitter”. Question: If the above situation persists, will the air be cleaner or dirtier 10 years from tomorrow? Answer: Dirtier if vehicle population continues to increase.
  - Health issues related to PM are becoming just plain “scary” and LD fleet is not “off the hook”. The is a large data gap as to how much LD contributes to inventories, and a general “belief” that the “very few” contribute “the most”.

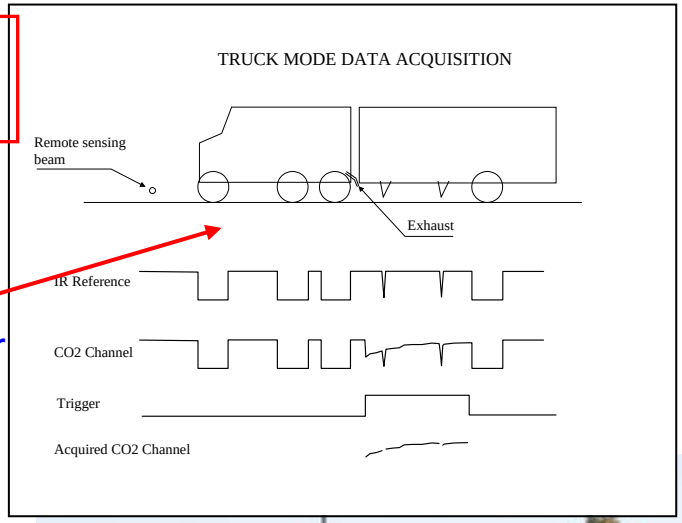
Light Duty Fleet

- Solutions:
  A. Use RSD to help fill the data gap for PM.
  B. Use RSD to identify the “very few”, confirm/measure using traditional (and/or newly evolving measurement methods, PM), and either repair, or retire the vehicles.
- Examples of Solutions for B. above:
  - Virginia RSD GE Program
  - Texas RSD GE Program
  - SC-AQMD RSD Pilot “Voluntary Repair and Retirement”

  ❖ Good news coming-ARB study: “Can RSD identify gross gasoline smokers?”

HD Diesel Fleet

Low Exhaust Pipe Vehicle

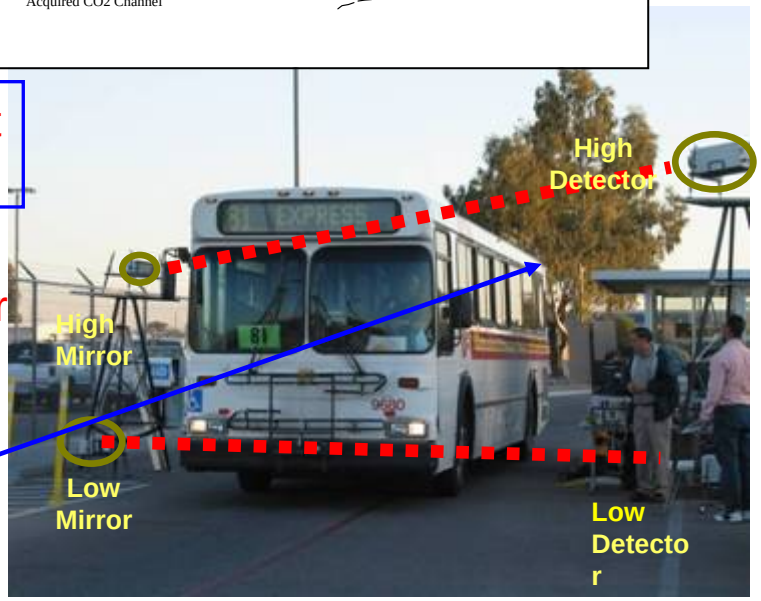


Measure Under Trailer

High Exhaust Pipe Vehicles

Measure Over Trailer

Measure Behind Bus



HD Fleet

- Basic Issues:
  - Huge in-use data gap! No one knows what is really out there! Limited data sets indicate the NOx is worse than it should be!
  - Traditional approaches of "legislating" emission standards for new engines/vehicles will be ineffective because of very slow fleet turnover. Diesels last 30-years!
  - Traditional testing approaches (dynamometer test cycles) are not politically viable. Yet, diesels don't produce NOx and Smoke unless they are loaded.
  - There are no meaningful in-use standards (except for 2007+ engines).
  - Jurisdictional issues paralyze action. "If I can't fix it, I don't want to know about it!"

❖ The focus of the technical community is upside-down. There is much technical hype about how to measure the new 2007+ standards for PM. This is focusing on the "very few" but the very few that are the clean!

HD Truck/Bus Fleet

- Solutions (Present to Near Term):
  - Use RSD to measure and characterize what is out there for HD trucks – fill the data gap.
  - Use RSD data acquired in existing programs to characterize HD Buses that have low exhausts.
  - Implement programs using RSD to identify the “very few” high emitters, then
    - Target for retrofit solutions (DPF’s)
    - Clean fuels usage
    - Ban/exclude from certain jurisdictions (e.g. port areas)
  - Use RSD to confirm emissions reductions from Retrofit and Clean Fuels targets.
  - Implement programs using RSD to identify the “very clean” (new or DPF retrofitted) for regional access zones (e.g. World Trade Center construction zone, port zones, etc.).

HD Truck/Bus Fleet continued

- Combine RSD emissions measurements for more selective safety screening. Poor emissions performance may well imply poor safety maintenance!
- Ongoing monitoring to identify any residual high emitting trucks for special testing and/or enforcement actions/penalties.

HD Example
Mariposa Border Crossing Study

esp

Mariposa Commercial Vehicle Crossing

Nogales, Arizona

Station 1
PEMS Setup

Station 3
RSD Testing

Station 2
Weight Station

Data Collection Activity

In-Use Emissions

- Station 1: PEMS/Opacity Activity
  - Staff: 3 Technicians
  - Recruitment: 15 minutes
  - Installation: 1.25 hrs to 3 hrs (including Opacity)
  - Chase: 45 minutes
  - Removal: 30 minutes
  - Return: 30 minutes

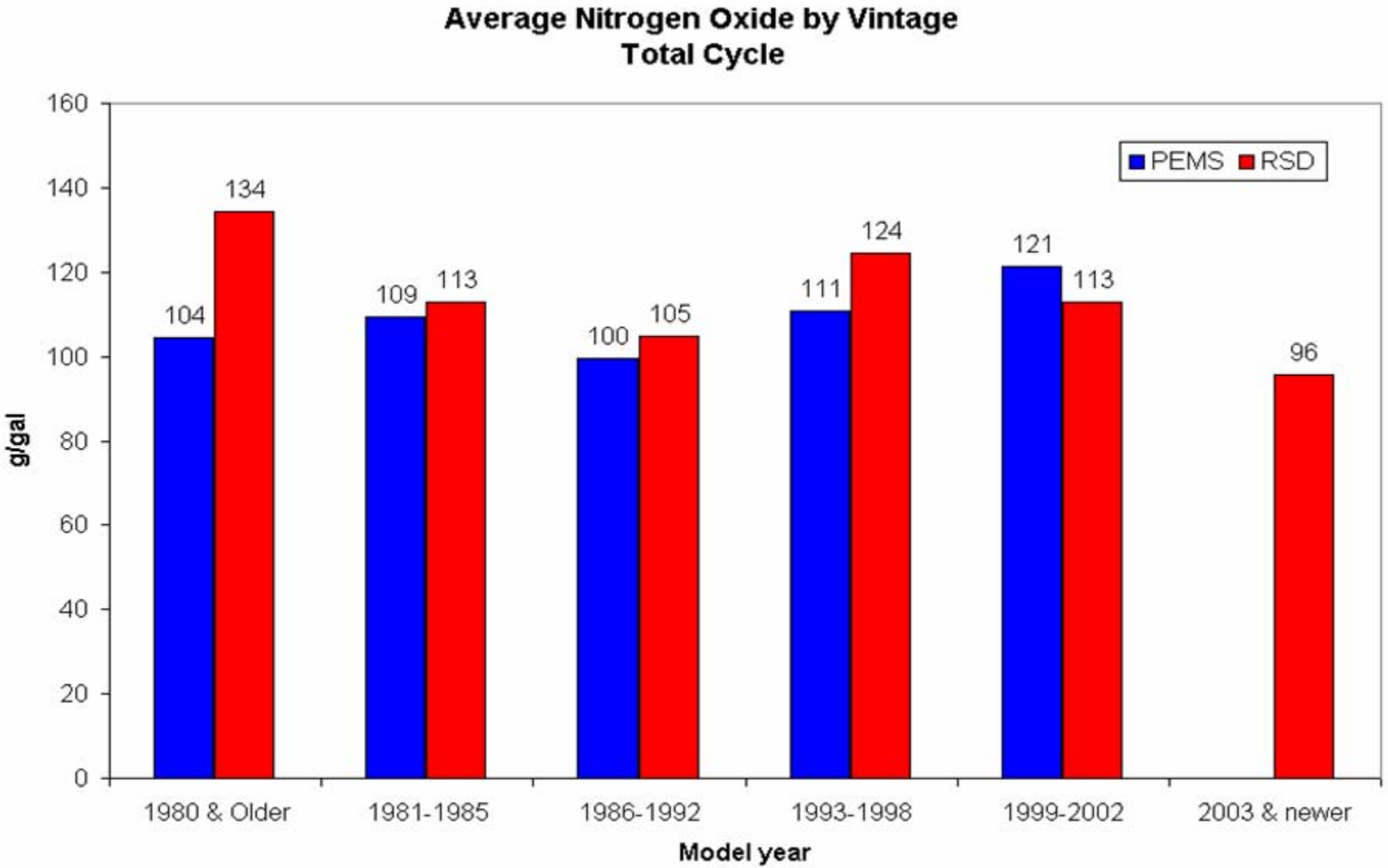
  3.25 hrs to 5 hrs

Data Collection Activity

In-Use Emissions

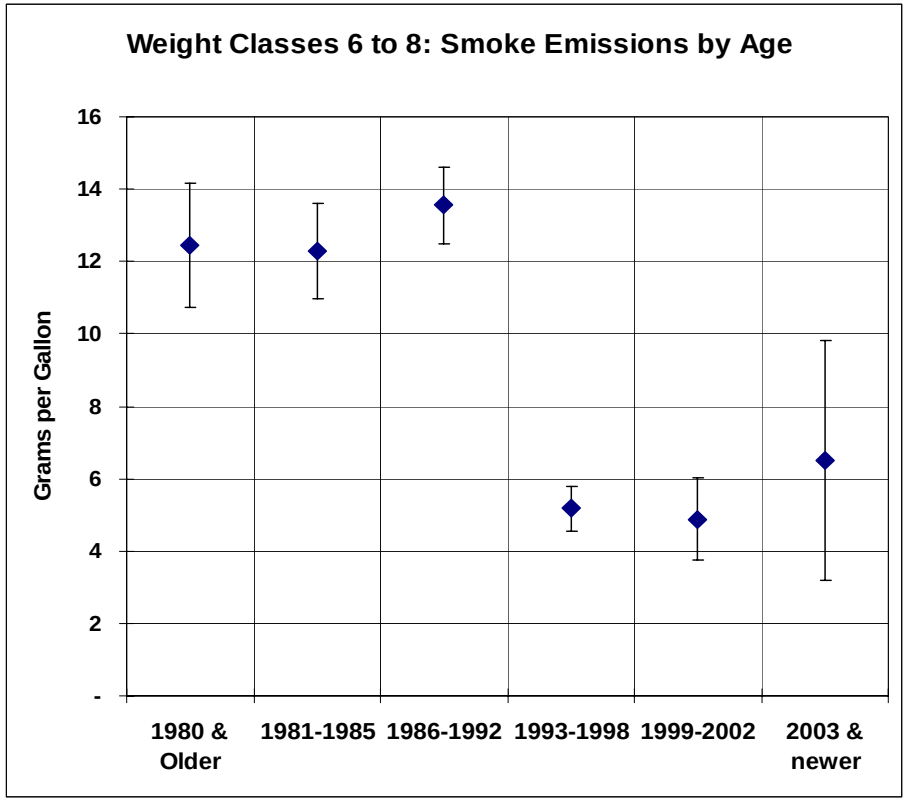
- Station 3: Remote Sensing
  - Staff: 6 Operators (3 per shift)
  - AM Set-up: 1.5 hrs
  - Collection Hrs: 9AM to 6PM
  - PM Tear-down: 45 minutes
  - Shifts: Two 6 hr shifts

NO Results by Vintage

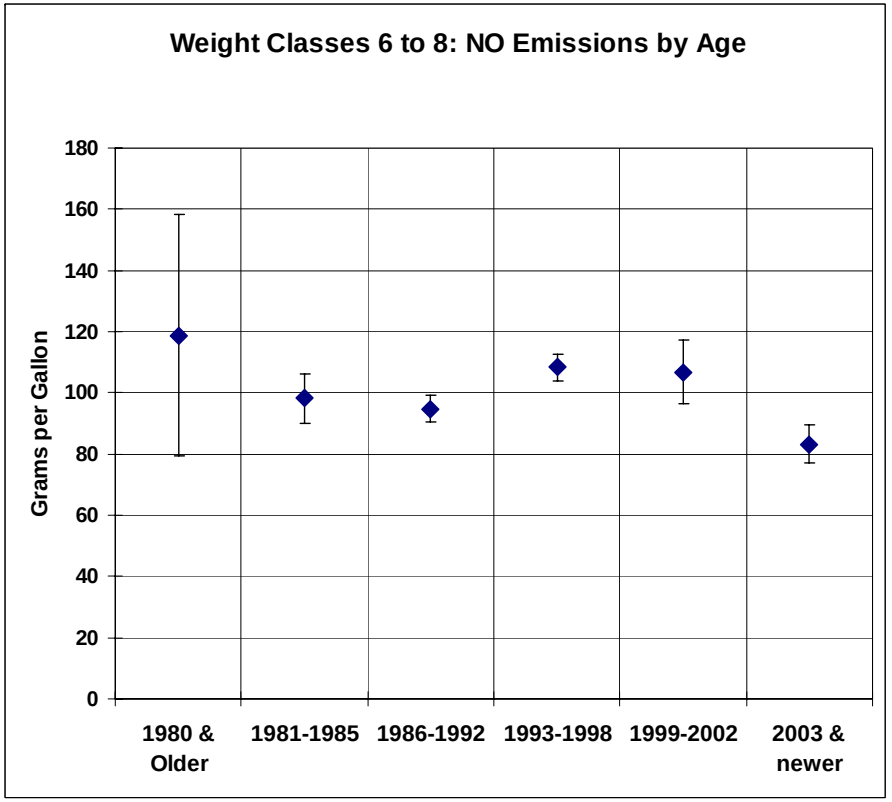


RSD Data - Model Year Trends

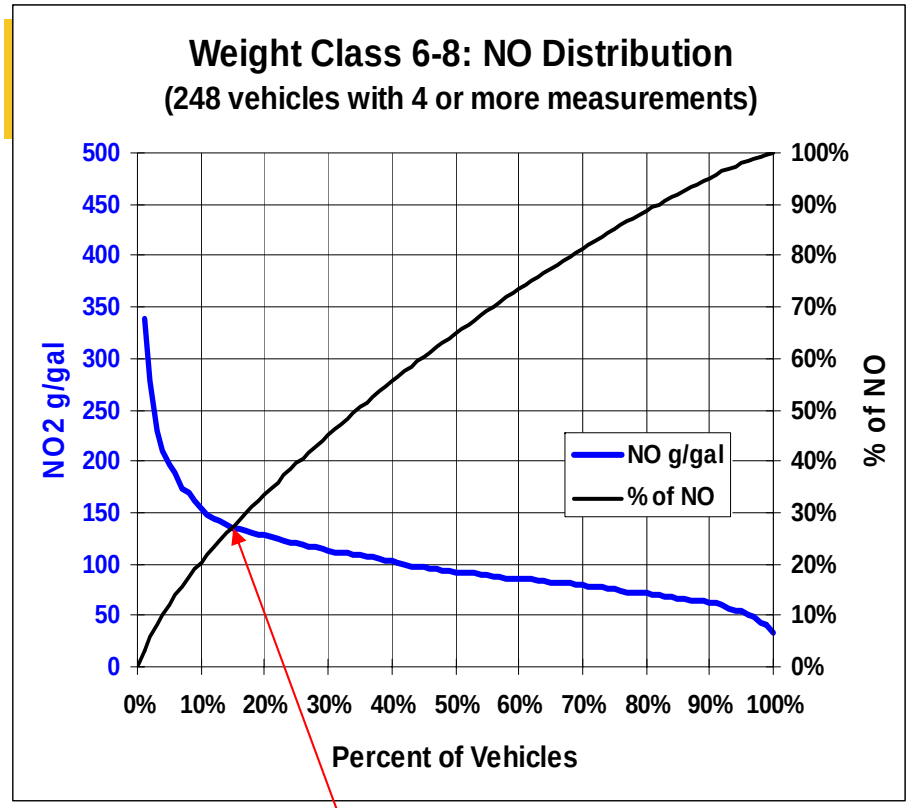
Dramatic reductions in PM



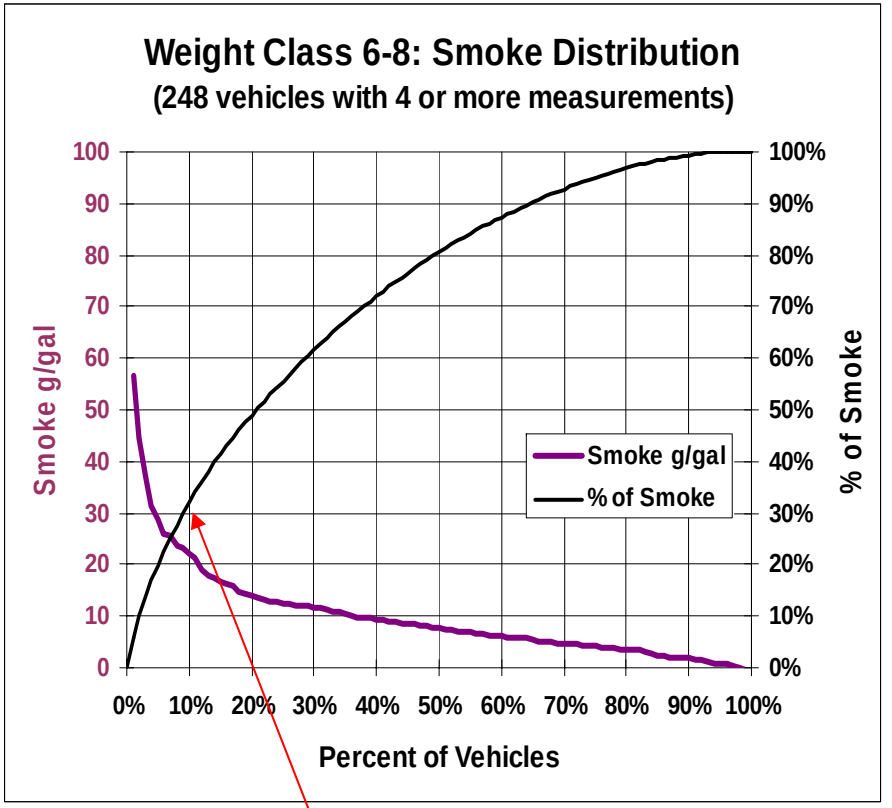
BUT, NOx remains level



Emissions Distribution: NO & PM

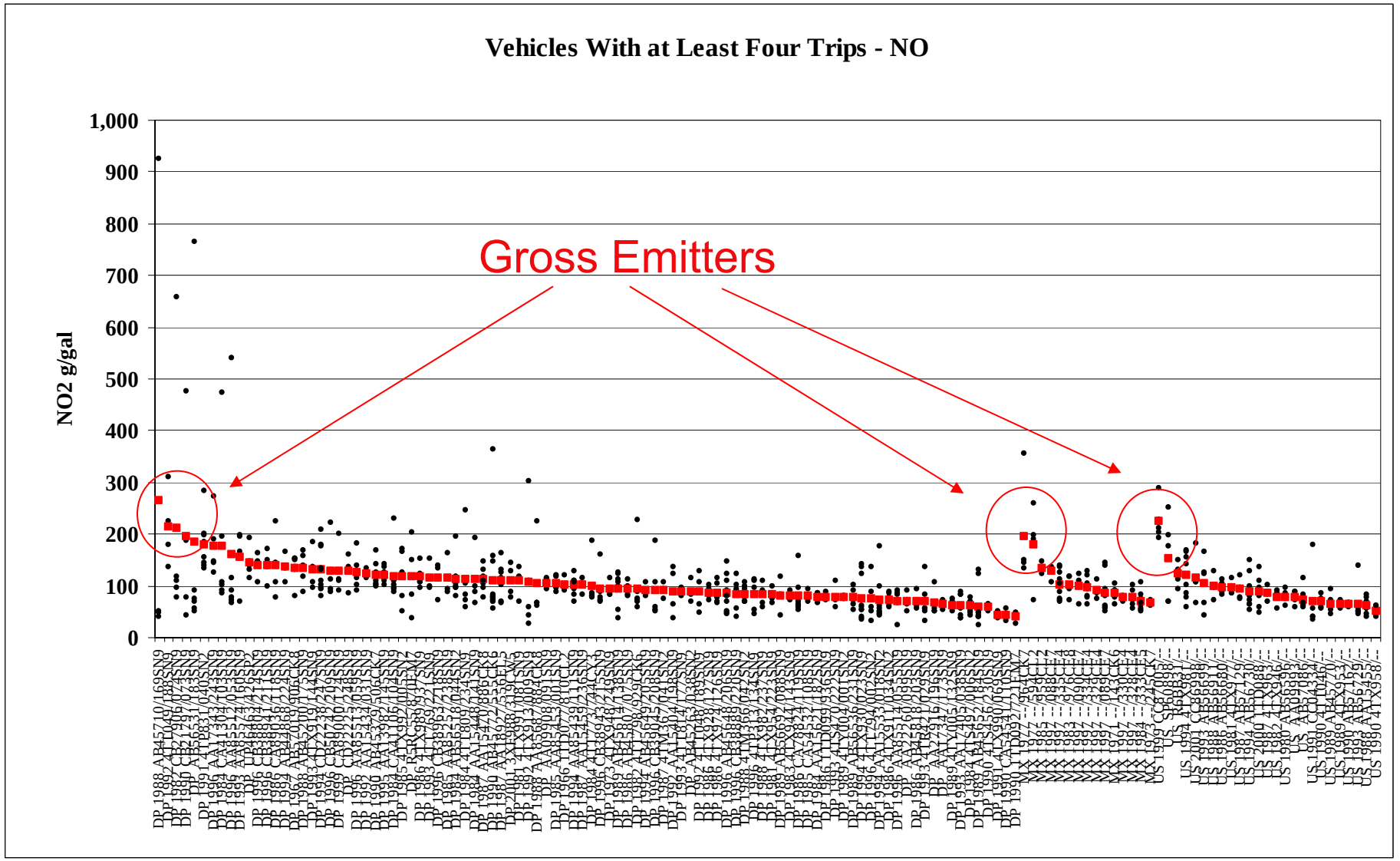


15% of trucks create almost 30% of NO

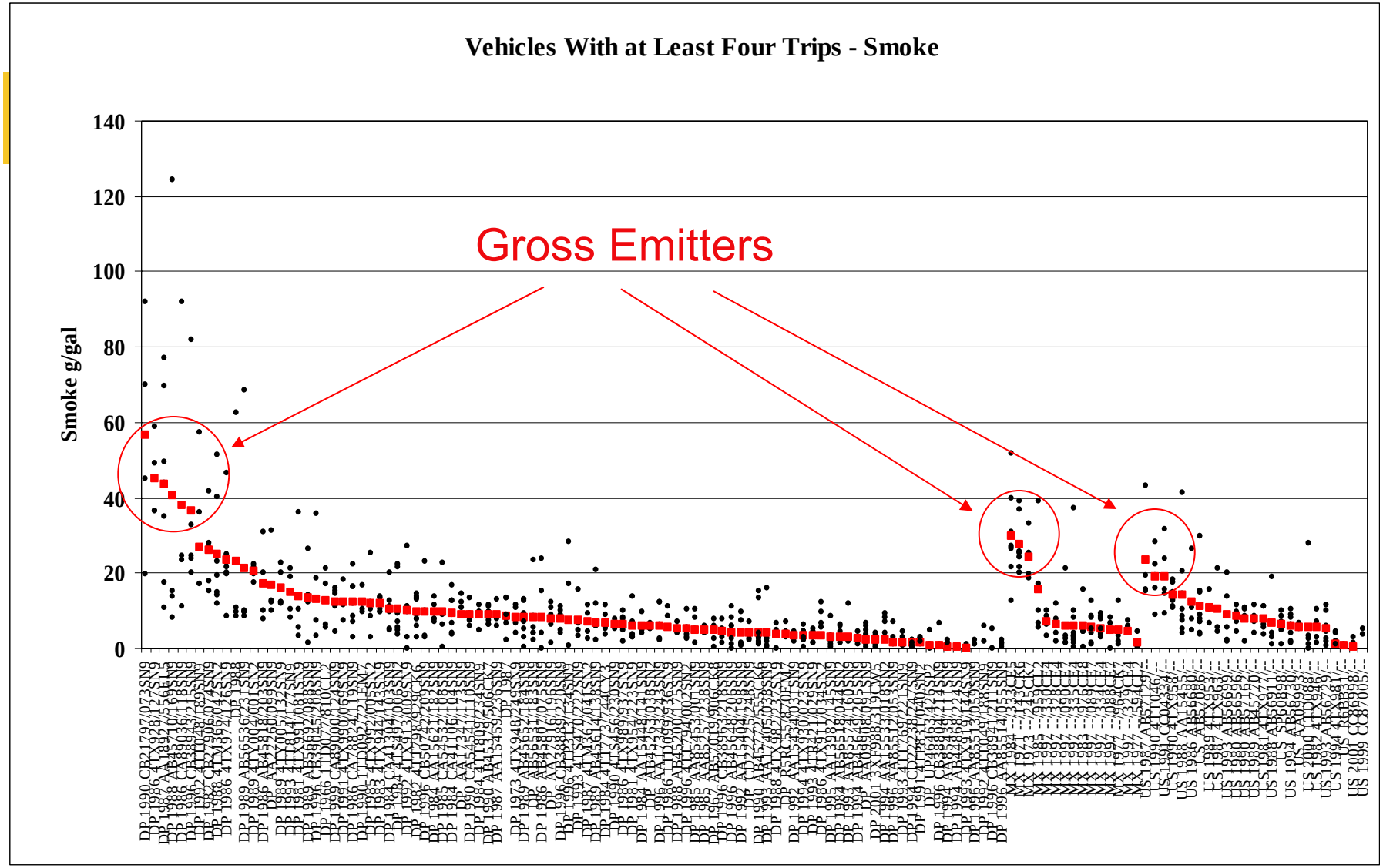


10% of trucks create 30% of Smoke

Individual Truck Results - NO



Individual Truck Results - PM

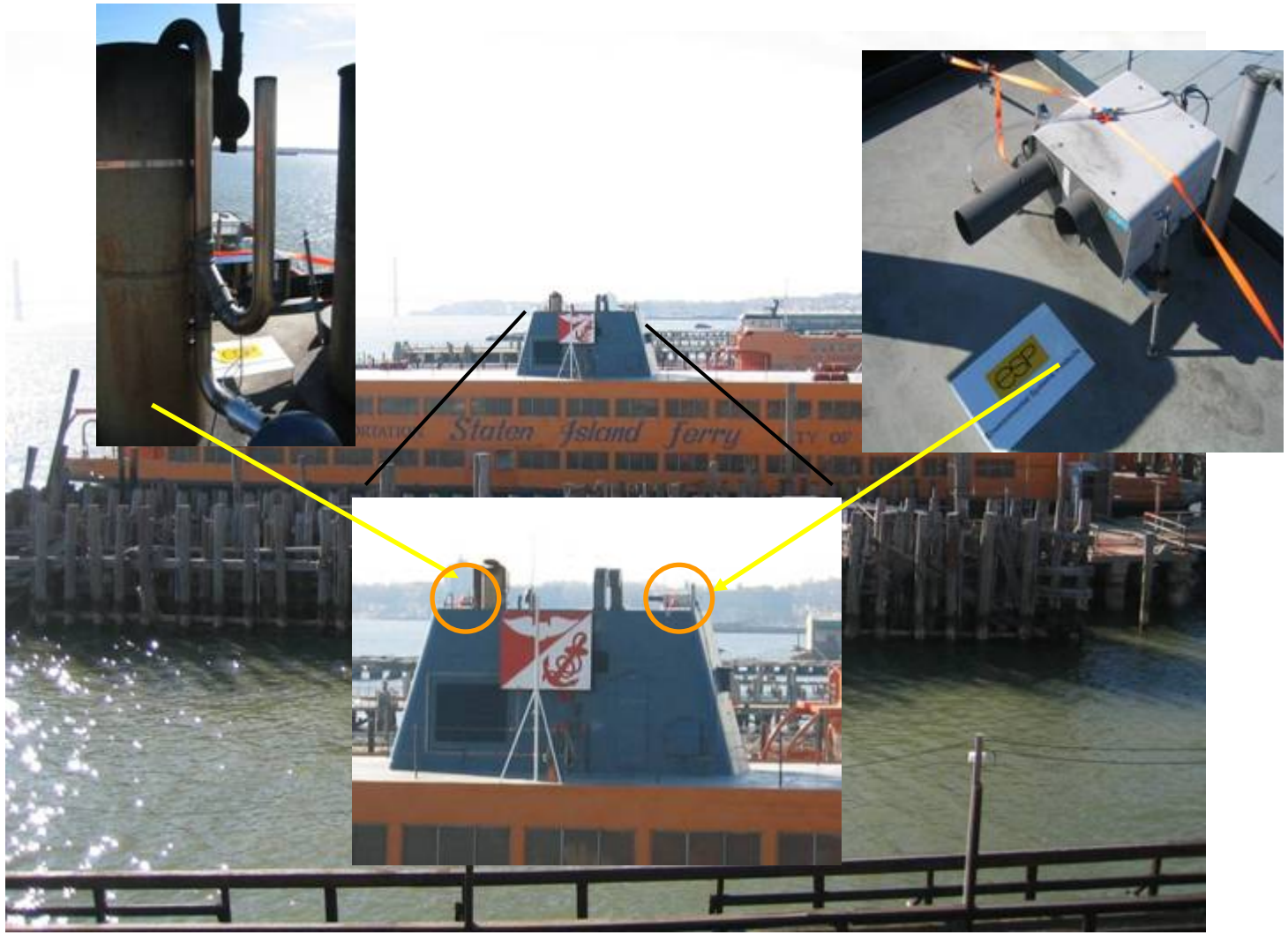


Locomotives

Locomotives

- Issues: Largely mimics HD trucks although the data gap is bigger.
- Solutions:
  - Near term:
    - Use RSD to characterize the fleet
    - Then plan accordingly
- Examples:
  - AB12222 mandates assessment of RSD capability to measure locomotive emissions.
  - Working with SC-AQMD and ARB we expect to be measuring locomotives at a railway research facility using RSD by end of year; and measuring on line locomotives in California early next year.

MARINE



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